How African is the Matterhorn?

Nikolaus Froitzheim[1], Thorsten J. Nagel[1] , Sybille Roller[2] & Jan Pleuger[3]

[1]Steinmann-Institut, Poppelsdorfer Schloss, D-53115 Bonn (niko.froitzheim@uni-bonn.de).

[2]Institut für Angewandte Geowissenschaften, TU Darmstadt, D-64287 Darmstadt

[3]Geologisches Institut, NO E 3, Sonneggstrasse 5, CH-8092 Zürich

At the end of his last great scientific article "Geologie der Iberger Klippen und ihrer Flysch-Unterlage" (2006), Rudolf Trümpy posed the question "how African the Matterhorn really is", referring to the tectonic and paleogeographic position of the Sesia / Dent Blanche Nappe to which the Matterhorn belongs. For Argand (1909), the Dent Blanche nappe was "Penninic". It was Staub who, after initially correlating the Dent Blanche with the Margna Nappe in Graubünden (1920) in a rather categoric way, changed his mind in 1938 and now correlated the Dent Blanche with the Err and Bernina nappes, thus labelling it "Austroalpine". For some reason, Staub's new interpretation became canonical until the present day. Equating "Austroalpine" with "African", a book cover showed a giraffe with the Matterhorn in the background (Marthaler, 2002) and a Swiss stamp (2005) showed the Matterhorn as an upside-down map of Africa. The Austroalpine affiliation was, however, repeatedly called into question, for example by Rudolf Trümpy.

We studied the Combin Fault, the tectonic contact between the blueschist-facies Tsaté Nappe (above) and the eclogite-facies Zermatt-Saas Nappe (below) which both represent ophiolite units from the Piemont-Ligurian Ocean. Today, they lie below the Sesia / Dent Blanche Nappe. A thin band of Mesozoic sediments (Cimes Blanches Nappe) and slivers of Sesia / Dent-Blanche-type basement rocks occur along the Combin Fault. The facies of the sediments indicates deposition on continental crust before they were detached. The Cimes Blanches sediments may either have been derived from the St. Bernard nappe (Briançonnais) by top-SE backshearing, or from the Sesia/Dent Blanche Nappe by top-NW pro-shearing. Our study shows that back-shearing was of relatively minor importance and only occurred after the Cimes Blanches sediments had been emplaced (Pleuger et al. 2007). Therefore, it is more likely that the sediments were derived from the same paleogeographic domain as the Sesia-Dent Blanche nappe.

We draw the following conclusions: (1) The Sesia / Dent Blanche nappe represents, together with the Margna Nappe, a microcontinent ("Cervinia") originally located between the Tsaté basin to the SE and the Zermatt-Saas basin to the NW; (2) the original stacking order of the nappes was, from base to top, Zermatt-Saas – Sesia / Dent Blanche / Cimes Blanches – Tsaté; (3) the Dent Blanche Nappe was emplaced on top of the Tsaté Nappe by later out-of-sequence thrusting which changed the stacking order; (4) the Sesia / Dent Blanche nappe is Penninic, not Austroalpine.

References:

Argand, E., 1909, Bulletin des laboratories de géologie etc. Univ. Lausanne, 14, 1-64.

Marthaler, M., 2002, Le Cervin est-il africain?, Editions L.E.P., Lausanne.

Pleuger, J., Roller, S., Walter, J. M., Jansen, E. & Froitzheim, N., 2007, Int. J. Earth Sci., 96, 229-252.

Staub, R., 1920, Eclogae geol. Helv., 16, 1-26.

Staub, R., 1938, Eclogae geol. Helv., 31, 345-353.

Trümpy, R., 2006, Eclogae geol. Helv., 99, 79-121.